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CONTENTS

Meeting of International Radio Consulting Committee in Lisbon, and of the International Scientific Radio Union in London.
Coil arrangements for producing a uniform magnetic field.
Drift of magnetic permeability at low inductions after demagnetization.
Determination of ethane by explosion with oxygen or air.
Observations of flame in an engine cylinder.
Gasoline knock rating.
Interference measurements in the spectra of the noble gases.
Medals awarded Bureau scientists by French technical society for work on photographic emulsions.
Carbon paper and typewriter ribbons.
Standards for checking opacity meters.
Zinc phosphate dental cements.
Forms of rubber as indicated by temperature-volume relationship.
Heats of combustion of rubber, and of rubber-sulphur compounds.
Knit underwear fabrics.
Standard sizes and measurements for knit underwear.
Proposed change in the method for measuring the acidity of sole leather.
Protective value of nickel and chromium plating on steel.
Matches.
Simplification of flash-light cases.
The system CaO–B_2O_3–SiO_2.
New and revised publications issued during August 1934.
Letter circulars.
Recent Bureau articles appearing in outside publications.

MEETING OF INTERNATIONAL RADIO CONSULTING COMMITTEE IN LISBON, AND OF THE INTERNATIONAL SCIENTIFIC RADIO UNION IN LONDON

On recommendation of the United States Department of State, Dr. J. H. Dellinger, chief of the radio section of the National Bureau of Standards, has been appointed chairman of the American delegation to the International Radio Consulting Committee (CCIR) which meets at Lisbon, Portugal, from September 22 to October 10, 1934. The other official delegates are Maj. Roger B. Colton, Signal Corps, United States Army; G. C. Gross, Federal Communications Commission; Capt. Stanford C. Hooper, United States Navy, and W. Vallie Whittington, Treaty Division, Department of State. The delegation will also include representatives of the American Telephone and Telegraph Co., American Radio News Corporation, International Amateur Radio Union, Mackay Radio & Telegraph Co., National Association of Broadcasters, and RCA Communications, Inc.

The International Radio Consulting Committee was established by the International Radio Conference of Washington, 1927, and reestablished by the International Telecommunications Conference of Madrid, 1932, to advise the radio administrations of the world on technical questions. The general objective of its work is the reduction of radio interference.

This committee has had 2 previous meetings at which a large number of questions were studied, leading to 50 "opinions" on a wide variety of technical radio problems. These opinions do not have the force of regulations, but they are accepted by all governments as the authoritative expression of the status of technical progress.

The subjects to be discussed at the Lisbon meeting are as follows: 1. Organization regulations of the CCIR; 2. participation of international organizations in the CCIR; 3. working of a mobile station accurately on the frequency of land station; 4. technical basis of allocation of bands of frequencies; 5. mitigation of harmonics in radio transmission; 6. reduction of electrical interference; 7. selectivity and frequency stability of radio receivers; 8. high-frequency call-

ing frequencies; 9. modulated telegraph transmission; 10. mitigation of key clicks in radio telegraph transmission; 11. standard frequency transmissions; 12. measurement of telephone noise and voice levels; 13. radio telephony between small ships and land stations; 14. telephony with moving trains; 15. coordination of fixed-station radio telephony and wire telephone system; 16. methods of measuring radio field intensity and noise; 17. synchronization of broadcast stations; 18. frequency separation between broadcast stations; 19. efficacy of directive antennas (150 to 1,500 kc/s); 20. efficacy of "anti-fading" antennas; 21. broadcasting by single sideband; 22. study of wave-propagation curves; 23. measurement of transmitter spectra; 24. revision of earlier CCIR Opinions; and 25. characteristics of arc transmitters.

Dr. Dellinger will also attend a session of the International Scientific Radio Union (URSI) in London, September 11–19. This is one of the unions in the International Council of Scientific Unions in which this country is represented through the National Research Council. The London session will include meetings of technical committees dealing with measurements and standards, propagation of waves, atmospherics, and radio physics. For these meetings the Bureau has prepared the following special reports: Radio frequency standards; an analysis of continuous records of field intensity at broadcast frequencies; frequency distribution of the intensities of radio atmospherics; report on Polar Year observations.

COIL ARRANGEMENTS FOR PRODUCING A UNIFORM MAGNETIC FIELD

Various arrangements of coils carrying current can be used to set up a magnetic field which is very nearly uniform over a restricted space. Such coil arrangements, when properly oriented, will effectively neutralize the earth's magnetic field over this space, and may be used in place of magnetic shielding to prevent the interaction with the local field, of apparatus whose action is influenced by a magnetic field. In the case of a cathode-ray oscillograph such neutralization is required over the long, narrow cylindrical volume which constitutes the path of the electron beam in the oscillograph. RP716 in the Journal of Research for September presents a study of the uniformity of the magnetic field set up by a pair of long rectangular coils which may be used for this purpose. Certain modifications in the shape of such coils are shown to result in a much greater degree of uniformity throughout the volume in which the local field must be neutralized.

DRIFT OF MAGNETIC PERMEABILITY AT LOW INDUCTIONS AFTER DEMAGNETIZATION

In many types of electrical apparatus, particularly in connection with various systems of communication, the magnetic core material is operated at very low values of magnetic induction. In specifying tests which may be applied to materials at low inductions, the American Society for Testing Materials permits the use of either of two alternative methods. Since the primary object of such tests is to determine whether or not material meets certain purchase specifications, it is obvious that the two methods should give the same results on identical samples within reasonable limits. In a short investigation, described in the September number of the Journal of Research (RP714), it was found that the magnetic permeability of commonly used materials changes with time after demagnetization. The change may amount to as much as 10 or 12 percent. The two testing methods under consideration were found to be in satisfactory agreement, if at least 18 hours is allowed to elapse between demagnetization and testing.

DETERMINATION OF ETHANE BY EXPLOSION WITH OXYGEN OR AIR

A paper in the September number of the Journal of Research (RP715) presents the results of a series of analyses of pure ethane by the explosion method. Explosions were made with commercial oxygen, pure oxygen, and air. The results are compared with previously reported data obtained by slow combustion. Large differences were observed between the various groups of analyses, and no group gave results corresponding to the ideal equations. These differences are partly explained by errors found and measured. In general, the explosion methods were very inaccurate—possibly far more inaccurate than is commonly suspected.

OBSERVATIONS OF FLAME IN AN ENGINE CYLINDER

When the spark occurs in the cylinder of an engine, it initiates a flame which spreads more or less rapidly to

all parts of the combustion chamber, the burning gases remaining luminous for some time after flame propagation is complete. The performance of the engine is affected by the rate of flame spread and the duration of the period of reaction and heat liberation following inflammation. Since an explosion is usually completed in about one one-hundredth of a second or less, special apparatus is required to follow visually or photographically the swift spread of the flame-front and to measure the rapid variations in radiations which indicate the duration of the reaction period.

Observations conducted with such apparatus at the Bureau under the sponsorship of the National Advisory Committee for Aeronautics have shown that in normal explosions the flame-front starts slowly from the spark plug, increases its speed to a maximum near the middle of its journey, and then slows down as it approaches the combustion chamber wall. The average flame speed for a normal explosion is about 70 feet per second (nearly 50 miles per hour). Flame speeds are decreased if the carburetor is set too rich or too lean, or if large amounts of residual gas from the previous explosion are mixed with the new charge, as occurs when the throttle is partly closed. In some manner which is imperfectly understood, an increase in engine speed causes an almost proportional increase in flame speed. This is very fortunate, for otherwise modern high-speed engines would be impractical. Flame travel is also affected in a complicated manner by combustion chamber design and the number and location of spark plugs. When "fuel knock" occurs, the progressive inflammation of a part of the charge is followed by practically simultaneous inflammation of the last portion to burn.

Radiation measurements indicate that in a normal explosion reactions may be still occurring in the charge near the spark plug when the flame-front reaches the opposite wall of the combustion chamber, but that reactions are completed much sooner after inflammation in that portion of the charge involved in "fuel knock."

GASOLINE KNOCK RATING

The relative tendency of gasolines to knock or detonate in internal combustion engines is evaluated by comparing them in a standard test engine with blends of two pure hydrocarbons: *normal heptane*, which knocks more readily than any gasoline, and *iso-octane*, which has less tendency to knock than any commercial gasoline. The percentage of iso-octane which must be blended with normal heptane to match a given gasoline in the knock-test engine is known as the octane number of the gasoline.

Fuels for automobile engines are rated according to ASTM method D357–33T, see Method 600.1 in Federal Specification VV–L–791 (Methods of Sampling and Testing Lubricants and Liquid Fuels) which can be obtained from the Superintendent of Documents, United States Government Printing Office, Washington, D.C., for 15 cents a copy. The test engine and procedure specified were developed over a period of years by the CFR Subcommittee on Methods of Measuring Detonation, which comprises representatives of leading automotive and petroleum laboratories and of the National Bureau of Standards. An extended series of cooperative road tests, to ascertain whether the ASTM octane numbers thus determined are in satisfactory agreement with the relative performance of representative motor fuels in the 1934 automobiles, was concluded on August 7 and the results are now being analyzed by the subcommittee. Most competitive-price gasolines today have knock ratings between 65 and 70 octane number. Gasolines of higher knock rating usually command a premium while the cheaper grade 3 gasolines may have ratings as low as 50 octane number. The grade of fuel required by any particular automobile depends on engine condition and type of service as well as on engine design.

The Cooperative Fuel Research Committee is also sponsoring the development of a standard method for rating aviation gasolines but, pending the outcome of this work, the ASTM motor fuel method is used by the United States Department of Commerce and the aeronautic industry for rating commercial aviation gasolines. The National Bureau of Standards has recently completed tests of 26 aviation gasolines in a 9-cylinder Wasp engine, capable of developing over 600 horsepower at rated speed. These gasolines included 3 reference fuels and 4 groups of test fuels. The test fuels ranged in octane number from 69 to 89 and each group represented a distinct type of commercially available fuel. The object of these tests was to compare the behavior of these diverse types of test fuels with the

reference fuels in a particular multicylinder aircraft engine under conditions of incipient detonation. Similar tests are being run by a number of engine manufacturers using other representative commercial aircraft engines. The results of all these tests will show whether any changes in the laboratory test procedure are required to obtain octane number ratings of aviation gasolines which agree with their average performance in modern aircraft engines. The fuel requirements of such engines range from below 70 to at least 87 octane number.

INTERFERENCE MEASUREMENTS IN THE SPECTRA OF THE NOBLE GASES

The fundamental standard of wave length for all precise measurements in spectroscopy and metrology is the red radiation of cadmium which has been compared with the meter. Secondary standards derived from other light sources and distributed throughout a large range of spectrum are obtained by measuring the wave lengths corresponding to selected spectral lines relative to the primary standard. For this purpose the wave lengths are compared by means of the interference phenomena they exhibit in Fabry-Perot interferometers. The spectra of the noble gases (helium, neon, argon, krypton, and xenon), because of convenience in use, exact reproducibility, and a distribution of intense monochromatic radiations, are especially suitable as standards. As described in the Journal of Research for September (RP710), wave lengths of the stronger lines in these spectra have been compared in the Bureau's spectroscopy section both with the fundamental standard and with red lines of neon previously measured relative to the red line of cadmium, and were found to be reproducible within a part in 50 millions. The measurements extended from the violet through the visible and into the infra red, and thus supply convenient and accurately determined standards in a considerable range of spectrum.

MEDALS AWARDED BUREAU SCIENTISTS BY FRENCH TECHNICAL SOCIETY FOR WORK ON PHOTOGRAPHIC EMULSIONS

At the meeting of the French Society of Photography and Cinematography held on January 26, 1934, it was unanimously voted to award the silver medal of the Society to Drs. Burt H. Carroll and Donald Hubbard as testimony of the importance which it attached to the work done by these members of the Bureau's staff while engaged in research on photographic emulsions. The report which recommended the award stated that the work of these two men in this field has been of great benefit to French investigators and industrialists. The Bureau greatly appreciates the action taken by the French Society in thus honoring two members of its staff and for expressing its commendation of this work, which, due to lack of funds, it has been impossible to continue.

CARBON PAPER AND TYPEWRITER RIBBONS

Every user of carbon paper and typewriter ribbons wishes to get the best and longest service from them. The Bureau has prepared a mimeographed letter circular, in which it is shown how anybody can make writing tests of carbon paper and typewriter ribbons, and select for himself the kinds that are best adapted to his special needs. Brief accounts are also given of the manufacture of these materials, and it is pointed out how their physical properties and their composition are related to their writing qualities.

When carbon paper is to be used for making only a small number, say up to 3, copies at 1 time, the most important test is serviceability, or wear-down. This consists in writing the same letters over exactly the same part of the carbon paper, about 15 times, or until the coating is worn off. The best paper will write the greatest number of lines that are of good intensity of color, and sharp enough to be read easily.

If it is desired to make a considerable number of carbon copies at one time, the manifolding test is made. In this, 5 sheets of the carbon paper, with an ordinary first sheet and 5 thin copy sheets are used. The numerals and the entire alphabet, both small letters and capitals, are written twice over. All the numerals of the fifth copy should be legible, and not more than 5 of the 104 letters should be so indistinct as not to be recognizable.

When making these tests, the first, or ribbon, sheet and the thin copy sheets should be identical with those to be used in actual service. The character of the carbon copies depends not only upon the hardness of the coating and other properties of the carbon paper, but also upon the thickness and stiffness of the first and the copy

sheets, the size of the type, the hardness of the rubber-covered platen, the touch of the operator, and other factors.

Typewriter ribbons are given a serviceability, or wear-down, test similar to that for carbon paper, but 100 lines are written. Then, after allowing the ribbon to rest undisturbed for a definite time, another line is written, in order to determine the recovery, or flow of ink in the fabric. Another test, to find out whether the ribbon has a tendency to clog the type, is made by writing the letter "e" 800 times, when the ribbon is moving in the usual way, and not kept still as in the serviceability test.

A few other determinations, which cannot be made without laboratory facilities, are briefly discussed. They are useful in specifications, but do not have such a direct bearing upon the writing qualities of carbon paper and typewriter ribbons as the test outlined here.

A copy of this Letter, Circular No. 424, will be furnished on request.

STANDARDS FOR CHECKING OPACITY METERS

Opacity of paper is commonly specified by the contrast-ratio method. According to this method the reflectance of the material backed by a perfectly absorbing surface divided by its reflectance when backed by a highly reflecting material, such as magnesium oxide, is taken as an index of opacity. Magnesium oxide, itself, is, however, commonly not used as the white backing because of its fragility; nor is the white backing placed in actual contact with the sample. Because of these and other sources of error, opacimeters frequently give erroneous results.

Glass standards for checking the accuracy of opacity readings when testing paper and other sheet materials such as tracing cloth, transparent wrapping papers, envelop paper, envelop windows, and particularly printing papers, can now be obtained from the National Bureau of Standards. As a result of the study reported in Research Paper No. 660, "Sources of error in measuring opacity of paper by the contrast-ratio method", BS J. Research, March 1934, it has also been found that opacity as determined by the Technical Association of the Pulp and Paper Industry method differs appreciably (for some papers by as much as 0.04 or 4 percent) from true contrast ratio defined in Bureau of Standards Circular No. 63.

To provide a means of checking the adjustment of opacity meters of the type described in Circular No. 63, to discover whether they are reading according to the TAPPI definition, opacity standards of opal glass have been developed. These standards are 5 by 20 cm rectangles, 1.5 mm thick, and are permanent and cleanable. The theory of their application is given, and the results of tests in which they were used are reported in RP709 in the September number of the Journal of Research. The opacities of these standards, according to the TAPPI method, fall between 80 and 90 percent (0.80 and 0.90 contrast ratio), which is the critical range for printing papers. A standard may be purchased from the Bureau for $15 or may be borrowed for 1 week free of charge.

A copy of Letter Circular No. 418, which contains detailed instructions for the use of these standards, may be obtained on request to the National Bureau of Standards. Copies of Research Papers Nos. 660 and 709, and of Circular No. 63 are obtainable only by purchase at 5 cents each from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C.

ZINC PHOSPHATE DENTAL CEMENTS

As part of the cooperative research on dental materials conducted at this Bureau by the Federal Government and the American Dental Association, an investigation of the physical and chemical properties of zinc phosphate dental cements has just been completed. A preliminary report of this investigation was published in the November 1933 issue of the Journal of the American Dental Association. The final report will appear in the November 1934 issue of the same journal.

Seventeen trade brands of cement were studied. Test methods and apparatus were developed to determine composition, consistency, setting time, crushing strength, dimensional change on setting, distintegration, and film thickness. Studies were also made on their hydraulic, adhesive, and other properties which might be considered significant in dental usage.

The major constituent of all powders, except one, was zinc oxide. This is sometimes modified, up to 13 percent, with magnesium oxide, or up to 4.5 percent with bismuth oxide. The liquids were phosphoric acid buffered with zinc oxide and aluminum hydroxide. The consistency was determined by measuring the diameter

of a disk of cement formed by pressing a definite volume of soft unset cement (0.5 cc) under a load (120 g) between 2 glass plates for 10 minutes. In the preliminary report the proportion of 1 g of powder to 0.5 cc of liquid was used. The setting time at mouth temperature varied from 5 to 15 minutes, and at 70° F. (65 percent humidity) from 5 to 40 minutes. The crushing strength varied from 3,500 to 16,500 lb./in^2. when store in water for 24 hours. All cements studied disintegrated somewhat when placed in water for 6 months. All shrank appreciably on setting when measured on a dental interferometer immersed in water. The properties of these cements were affected markedly by temperature and slightly by humidity changes. Adhesion, if the term may properly be applied to these cements, was found to be entirely mechanical in the set cement. No cement was truly hydraulic as all showed increased deterioration if exposed to water during setting. After 7 days immersion in distilled water a disintegration of from 0.1 percent to over 10 percent by weight was noted. Manifestly those cements showing large percentage disintegration are inferior materials.

A tentative specification was formulated by the Bureau's dental laboratory. This specification was submitted to manufacturers, dental schools, and a large committee of dentists for criticism and suggestions for improvement. It was finally submitted to the American Dental Association in St. Paul on August 10 for consideration. The specification was adopted as A.D.A. Tentative Specification No. 8 for Dental Cementing Medium to become effective July 1, 1935. This will be used as a standard of quality for dentists who use this material.

The following is a summary of the detail requirements:

Consistency of mix	Disk, 30±1 mm in diameter.
Time of setting at 99° F.:	
Minimum	4 minutes.
Maximum	10 minutes.
Ultimate compressive strength:	
Minimum, 1 hr	350 kg/cm^2 (5,000 lb./in.^{2}).
Minimum, 7 days	840 kg/cm^2 (12,000 lb./in.^{2}).
Film thickness: Maximum.	50 microns.
Disintegration: Maximum.	1 percent by weight.

FORMS OF RUBBER AS INDICATED BY TEMPERATURE-VOLUME RELATIONSHIP

The Bureau has recently completed a study of the way in which the volume of rubber changes with changes in temperature. This study sheds considerable light on the forms in which rubber may exist at different temperatures. It has long been known that when unvulcanized rubber is cooled slowly, it undergoes a change similar to feezing, but when cooled quickly it may remain in the ordinary, elastic form. In the present investigation described in the September number of the Journal of Research (RP717), precise measurements have been made of the relative volumes of the two forms of rubber at temperatures down to −84° C (−120° F.). Rubber in the crystalline form has been found to occupy a volume 2 to 3 percent less than in the elastic forms. The transition of frozen rubber back to the ordinary form does not occur at a definite temperature, but takes place gradually from 6 to 16° C (43 to 61° F).

When both the ordinary and the crystalline forms of rubber are cooled to −73° C (−100° F) or below, they undergo changes to still other forms which are characterized by much lower coefficients of expansion than the products from which they are derived.

Vulcanized rubber, unlike crude rubber, does not crystallize on slow cooling but it does undergo a change to another form at a temperature somewhat above −73° C (−100° F). The temperature at which the change occurs depends on the percentage of sulphur used to vulcanize the rubber.

The fact that rubber may exist in different forms, as shown by temperature-volume measurements, is of general and basic significance. A close correlation has been found between present results and such diverse properties of rubber as the heat capacity, the dielectric constant and the behavior on stretching.

HEATS OF COMBUSTION OF RUBBER AND OF RUBBER-SULPHUR COMPOUNDS

A knowledge of the properties of rubber is of great importance in view of the extensive use of this substance in industry. Recognizing this fact, many industrial laboratories have devoted much time and money to investigations of the chemical and physical properties of rubber. Many of these investi-

gations have been carried out with commercial rubber, which usually contains considerable amounts of impurities. Investigations of such material are of great value in solving practical problems arising in the manufacture and industrial use of rubber.

For a complete understanding of the nature and properties of rubber, however, it is necessary to investigate materials of high purity, and to make measurements requiring the use of equipment which is not available in most industrial laboratories.

Realizing the need for a fundamental study of the properties of rubber, the Bureau has, for several years, been investigating the properties of pure rubber and compounds of pure rubber and sulphur.

Recently work has been started on an investigation of the thermal properties of rubber and its compounds with sulphur. RP713 in the September number of the Journal of Research describes a part of this work, namely, the determinations of the heats of combustion of rubber and rubber-sulphur compounds, and the calculation of the heat of vulcanization of rubber.

The importance of heat combustion measurements on a compound such as rubber lies in the fact that the results of such measurements, together with certain other data, can be used to calculate a quantity known as the free energy of formation of the compound. This quantity is of interest to the chemist in that it shows the conditions under which chemical reactions involving the compound can take place.

KNIT UNDERWEAR FABRICS

Knit underwear is made in a variety of weights, thicknesses, and constructions from cotton, wool, silk, rayon, and combinations of these fibers; but comprehensive data on the properties of underwear fabrics have not been available. In order to obtain this basic information, approximately 100 representative knit fabrics used for the manufacture of underwear were studied by the Underwear Institute (then the Associated Knit Underwear Manufacturers of America) in cooperation with the Bureau. This work is reported in RP711 in the September number of the Journal of Research.

The thermal transmission, air permeability, thickness, weight, compressional characteristics, and coefficient of friction were measured under specified conditions. The fiber composition and details of construction of the fabrics were determined, and charts showing the interrelations between properties are included in the report. In these charts, the constructions and fiber compositions of the individual fabrics are indicated. In general, the thermal transmission and air permeability of the fabrics varied inversely with thickness and with weight, the total compression varied directly with thickness, and the compressibility varied directly with density. The coefficient of friction was lowest for fabrics made from continuous filament silk and rayon yarns. The data show, however, that when any one property is fixed, the other properties may be varied considerably.

It is believed the results of this study will be of interest to the physiologists and students of clothing who are interested in the development of underwear of optimum properties from the standpoint of comfort and health and to the manufacturers of underwear, who will, through these data, have some basis for developing new constructions of fabrics to meet specified requirements.

STANDARD SIZES AND MEASUREMENTS FOR KNIT UNDERWEAR

Commercial Standard CS33–32 for "Knit underwear (exclusive of rayon)" has been a part of the knit underwear industry's code of fair competition since the code became effective on October 2, 1933. Briefly, this Commercial Standard contains standard sizes and measurements for men's, women's, boys', and children's ribbed and flat knit union suits and two-piece underwear, men's and boys' ribbed and flat knit athletic shirts and union suits, infants' shirts and bands, children's sleeping garments, and men's knitted polo shirts. Copies of this standard may be obtained from the Superintendent of Documents, United States Government Printing Office, Washington, D.C., at a cost of 15 cents each.

Part V, section 2 of the Underwear Code provides for suitable marking of knit underwear not made according to Commercial Standard CS33–32 by the following paragraph: "All standards already formulated in cooperation with the Bureau of Standards of the United States Department of Commerce and approved by the Industry or standards which shall be so

formulated and approved shall become the standards for the industry. Every manufacturer shall plainly mark with an indelible stamp or firmly sewn label the sizes or measurements of his product thereon. All merchandise manufactured after the effective date, which falls below the minimum size standards, shall be plainly and visibly marked by an indelible stamp or firmly sewn label NOT-STANDARD SIZE, and all manufacturers shall stamp or label such goods as herein required prior to actually putting the merchandise in stock, or, in other words, as a part of the manufacturing process. However, any merchandise manufactured prior to the date of adoption of a standard for such merchandise, shall not, in any case, be classified as NOT-STANDARD SIZE merchandise, and the managing director shall notify all known interested persons in the industry of each new standard adopted and the effective date thereof."

Since February 1, 1934, the Underwear Institute (formerly the Associated Knit Underwear Manufacturers of America) has been cooperating with the National Bureau of Standards in the development of standard sizes and measurements of knit underwear garments of types that had not previously been included in Commercial Standard CS33–32. The purpose of this joint project is to lessen unfair competition and give greater satisfaction to the consumer by the adoption of standard sizes and measurements as a part of the industry's code under the provisions of the National Industrial Recovery Act.

The actual work of developing these new standards is being done at the Bureau by a research associate working under the Standardization Committee of the Underwear Institute. The personnel of the committee is as follows: Ralph M. Jones, chairman, L. U. Lynt, L. Maher, J. Sinnott, Walter Powell, Lyndall Carter, John Shea, G. F. Earnshaw, J. C. Van Dyle, W. J. Ross, William Ravner, and George Traber. The Consumers Advisory Board, NRA, has been invited to be represented at each meeting of the committee.

The procedure followed in developing standard sizes and measurements for the new items is first to ascertain the present practice of the industry by means of questionnaires which are sent out to all knit underwear manufacturers by the Underwear Institute. All measurements are made and reported on the questionnaires according to standard methods of measuring and diagrams. As the questionnaires are received from the manufacturer, the measurements are tabulated at the Bureau. When it is evident from the number of replies that the data are representative of the entire industry, the measurements are averaged. Using these averages as a basis, proposed standard measurements are developed at the Bureau by the research associate and are then presented to the Standardization Committee for consideration. Garments of key sizes are sometimes made according to the proposed measurements and modeled as a check. Allowance is made for shrinkage in the selection of the proposed measurements.

The proposed standards as revised or changed by the committee in the light of its practical manufacturing experience are next submitted to the whole industry for a mail vote. If an overwhelming majority of the industry approves of the proposed standards as recommended by the committee, they are then presented to the code authority of the industry for its approval. If approved, an effective date is selected and upon notification from the Underwear Institute of the adoption and approval of the standards, they become a part of the code after the effective date.

At the present time, standards for the following items have been developed and approved by the industry. It is expected that they will be presented to the code authority at its next meeting. These include measurements for men's and boys' flat fleece sweat shirts; women's and children's ribbed straight vests and bloomers; women's and children's tuck stitch vests; panties and union suits; change in method of measuring width of leg of boys' and children's knit union suits; change in width of boys' ribbed knit athletic shirts and "small", "medium", and "large" size designations to correspond to the chest sizes of men's and boys' ribbed knit athletic shirts.

Proposed standards have recently been worked out for women's and children's swiss ribbed straight vests, boys' swiss ribbed athletic shirts, men's and boys' flat fleece sport coats, and widths of men's and boys' panel ribbed athletic shirts. Proposed changes in the present standards for armhole and collarette lengths of men's and boys' ribbed and flat knit athletic shirts, and

total lengths of boys' ribbed and flat knit regular knee length and athletic union suits have likewise been developed, based on a survey of present-day practice of the industry. These items and changes will be presented to the Standardization Committee at its next meeting and will follow the same procedure as given above.

After all the new standards and changes have become a part of the code for a reasonable trial period, it is expected that the Underwear Institute will request the National Bureau of Standards to call a general conference of manufacturers, distributors, and users of knit underwear for the purpose of revising Commercial Standard CS33–32 to include these new standards and changes.

PROPOSED CHANGE IN THE METHOD FOR MEASURING THE ACIDITY OF SOLE LEATHER

During the past few years the National Bureau of Standards has been conducting researches relative to the effects of sulphuric acid on the life and properties of heavy leathers. It has been found that the deterioration of vegetable-tanned leather due to sulphuric acid starts near pH 3 independent of the kind of tanning material used, the aging conditions, the degree of tannage, and the amount of acid in the leather. Recently results of aging tests on leathers treated with oxalic acid have been completed and the same tendency for deterioration to start near pH 3 was observed. The advice and assistance of an advisory committee, which jointly represented the trade and technical interests in the industry, were had in this work.

These two acids are the ones commonly used in the manufacture of commercial sole leather. The results of the research make it appear that a pH measurement is a better criterion of the harmful acidity than the present Proctor and Searle method for the following reasons: 1. The above-described research which shows that the leathers containing both acids start to deteriorate at about the same pH regardless of the acid content; 2. the Proctor and Searle method does not show the presence of oxalic acid; 3. the amount of sulphuric acid required to deteriorate leather varies with a number of conditions. In this work the amount present varied from about 0.3 to 1.8 percent at pH 3. In some commercial leathers it runs as high as 2.3 percent, as determined by the Proctor and Searle method, although the leathers are satisfactory with respect to harmful acidity.

In the case of sole leather, which is usually consumed within a short period, it is believed that a minimum pH limit of 2.75 will insure the procurement of satisfactory material so far as acidity characteristics are concerned. It is proposed to revise the Federal specification for sole leather by substituting this limit in place of the present 1 percent limitation as determined by the Proctor and Searle method. The revision has been approved by the Committee on Leather Products of the Federal Specifications Board, and the matter has now been presented to interested industrial groups for consideration.

PROTECTIVE VALUE OF NICKEL AND CHROMIUM PLATING ON STEEL

When chromium plating was first applied, for example to automobiles, and was found to produce and maintain a high luster, it was assumed that the application and importance of nickel plating would be decreased. It was soon found, however, that the chromium is useful chiefly for reducing tarnish of the surface and that it does not add greatly to the protection of the steel against corrosion. Such protection depends principally upon the quality of the nickel plating that is applied to the steel prior to chromium plating. Actually, therefore, nickel plating has been used to a greater extent and its quality has been improved since the advent of chromium plating.

Data on the best thickness and conditions of deposition of nickel and chromium and on the advantages of an intermediate layer of copper were lacking. To obtain this information, the American Electroplaters' Society and the American Society for Testing Materials cooperated with the Bureau in extensive exposure tests of plated steel. Flat rectangular specimens were plated under specified conditions and were exposed continuously to the weather in six localities, which included marine, industrial, and suburban atmospheres. They were inspected at intervals for rust and other defects. Exposure for periods up to 2 years yielded the following conclusions:

Protection against corrosion depends principally upon the impermeability of the nickel coatings. The only practicable way to decrease the porosity is

to increase the thickness of the nickel. For severe exposure the nickel coating should be at least one-thousandth inch (0.025 mm) thick, and for mild or indoor use at least one-half that thickness.

The presence of a copper layer in very thin coatings decreases their protective value, but in thick coatings, especially if they are chromium plated, a layer of copper is not objectionable.

Relatively thin chromium coatings, for example 0.00002 inch (0.0005 mm) such as are now applied commercially, improve the appearance, and if the previous deposits of nickel and copper are satisfactory, they give good service. For very severe exposure, especially in an industrial atmosphere, much thicker chromium coatings are desirable.

It is expected that the use of this information by manufacturers, for example in specifications, will lead to more uniformly satisfactory plating on steel.

A complete account of this work will be found in RP712 in the Journal of Research for September.

MATCHES

The Bureau frequently receives requests for information on matches and in order to facilitate answering such inquiries a mimeographed Letter Circular No. 423, has been prepared which outlines the history, gives formulas, and describes their manufacture. Copies of this letter circular may be obtained on request to the Bureau.

SIMPLIFICATION OF FLASHLIGHT CASES

Simplified Practice Recommendation R68–33 for metal and fiber flashlight cases is a revision of the original recommendation covering this commodity issued in 1927. Seven types of cases are listed. These are 2- and 3-cell focusing spotlights, 3- and 5-cell focusing searchlights, 2-cell regular nonfocusing searchlight, 3-cell miner nonfocusing searchlight, and an optional type of 2-cell light. Definitions are given for each type of flashlight, approximate size of heads, as well as diameter and length of each size of cell.

In submitting the revision, C. A. Gillingham, acting chairman of the standing committee, prefaced the new schedule as follows:

SECTION I. In the . . . table are listed those types of flashlight cases which shall be considered as standard types and be so designated by the manufacturers in their catalogs and lists. It is understood that the items listed should adequately serve the various purposes for which the conventional types of flashlight case is intended and should constitute the major portion of the various manufacturers' normal output for such purposes.

In addition to the . . . list of types the revised recommendation provides for a limit of one finish, black, nickel plated or chromium plated, as the manufacturer may prefer for each of the 7 types. The industry also reserves the right to retain or develop special types of cases to meet particular needs and to bring out novelty types to stimulate interest in and sale of flashlight cases in general.

Those interested in this revised recommendation can obtain copies from the Superintendent of Documents, United States Government Printing Office, Washington, D.C., at 5 cents each.

THE SYSTEM $CaO.B_2O_3.SiO_2$

To determine the effect of boric oxide upon the melting points and temperatures of formation of the calcium silicates contained in portland cement, namely, dicalcium silicate and tricalcium silicate, a study of the ternary system $CaO.B_2O_3.SiO_2$ is in progress. The binary system $CaO.B_2O_3$ was already been investigated by E. T. Carlson (BS J.Research 9,825(1932); RP510); and that of $CaO.SiO_2$ by Shepherd, Rankin, and Wright (Am. J. Sci., [4]22,265(1906)). In working out the fields of $3CaO.SiO_2(C_3S)$ and of $2CaO.SiO_2.(C_2S)$ in the ternary system it was found necessary to extend the investigation to the adjacent fields of $3CaO.2SiO_2(C_3S_2)$ and of $CaO.SiO_2$ (CS) as well as to the fields of the calcium borates, $3CaO.B_2O_3(C_3B)$, $2CaO.B_2O_3(C_2B)$, and $CaO.B_2O_3(CB)$. This more complete study is of significance not only with respect to cement chemistry but in relation to the constitution of enamels and ceramic glazes. The portion of the system lower in lime and higher in silica and boric oxide has a bearing upon the constitution of borosilicate glasses.

The following binary or pseudobinary systems belonging to the ternary system have been completely or

partially worked out by heating curves and quenchings upon 114 different compositions; CB.CS, CB.C_3S_2, CB.C_3S, CB.C_3S, C_2B.C_2S, C_2B.C_3S, and C_3B.C_2S. Melts containing 44.3 percent C_2B, 55.7 percent C_3S, or 58.0 percent C_3B, 42.0 percent C_2S form the ternary compound $5CaO.B_2O_3.SiO_2$ (C_5BS). Determinations of the primary phases and melting points of the various compositions have indicated approximately the boundary curves of the fields of C_2S, C_3B, C_2B and partially the limits of the fields of CS, C_2BS, and CB.

It has been found that dicalcium silicate takes up considerable quantities of boric oxide (added as monocalcium borate) in solid solution by which the alpha-beta inversion temperature is lowered as much as 130° C.

NEW AND REVISED PUBLICATIONS ISSUED DURING AUGUST 1934

Journal of Research[1]

Journal of Research of the National Bureau of Standards, vol. 13, no. 2, August 1934 (RP nos. 699 to 708, inclusive). Price 25 cents. Obtainable by subscription.

Research Papers[1]

[Reprints from the June and July 1934 Journal of Research]

RP685. An absolute determination of the ampere; H. L. Curtis and R. W. Curtis. Price 10 cents.

RP686. Calorimetric determination of the heats of combustion of ethane, propane, normal butane, and normal pentane; F. D. Rossini. Price 5 cents.

RP687. Study of the system CaO—SiO_2—H_2O at 30° C. and of the reaction of water on the anhydrous calcium silicates; E. P. Flint and L. S. Wells. Price 5 cents.

RP690. Properties of white Braille papers for Library of Congress publications; C. G. Weber. Price 5 cents.

RP693. Thermal expansion of artificial graphite and carbon; P. Hidnert. Price 5 cents.

RP695. Variations in refractive index of CO_2-free dry air and a statistical correlation with solar activity; L. W. Tilton. Price 5 cents.

RP697. Photochemical decomposition of silk; M. Harris. Price 5 cents.

RP698. Contribution to the design of compression members in aircraft; W. R. Osgood. Price 5 cents.

Simplified Practice Recommendations[1]

R36–34. (2d edition.) Milling cutters. Price 5 cents.

Technical News Bulletin[1]

Technical News Bulletin No. 208, August 1934. Price 5 cents. Obtainable by subscription.

LETTER CIRCULARS

It is the intent of the Bureau to distribute single copies of these letter circulars on request only to those parties having special interest in the individual letter circular. Economy necessitates limitation in the number of copies issued. It is not the intent to supply parties with a copy of each letter circular issued during the month. Letter circulars are necessarily of a temporary nature designed to answer numerous inquiries on a given subject. Requests should be addressed to the National Bureau of Standards.

LC422. The painting of structural metal (steel, galvanized metal, tin plate, and copper).

LC423. Matches (history and manufacture).

LC424. Carbon paper and typewriter ribbons. (Suggests tests for the users of these materials.)

OUTSIDE PUBLICATIONS[2]

H. S. Bean, *Testing laboratory wet gas meters.* American Gas Journal (53 Park Place, New York, N.Y.), 141,31 (July 1934).

G. M. Kline, *Polymerization of olefins. The action of sulfuric acid on methylisopropylcarbinol.* Dissertation submitted for degree of Doctor of Philosophy, University of Maryland, College Park, Md. (June 1934).

W. G. Brombacher, *Measurement of altitude in blind flying.* National Advisory Committee for Aeronautics, Washington, D.C., Technical Note no. 503 (August 1934) mimeographed. Free on application to the NACA.

[1] Send orders for publications under this heading only to the Superintendent of Documents, United States Government Printing Office, Washington, D.C. Subscription to Technical News Bulletin, 50 cents per year; Journal of Research, $2.50 per year (United States and its possessions, Canada, Cuba, Mexico, Newfoundland, and Republic of Panama); other countries, 70 cents and $3.25, respectively.

[2] These publications are not obtainable from the Government unless otherwise noted. Requests should be sent direct to publishers.

R. C. Bowker (chairman), *Report of the committee on the determination of acid in leather, 1934.* Journal, American Leather Chemists Association (Ridgeway, Pa.), 29,403 August 1934).

R. C. BOWKER and E. L. WALLACE, *Comments on the Proctor-Searle method for determining the acidity of vegetable tanned leather.* Journal, American Leather Chemists Association (Ridgeway, Pa.), 29,421 (August 1934).

R. H. Bogue and W. Lerch, *Hydration of portland cement compounds.* Paper no. 27 of the Portland Cement Association Fellowship, National Bureau of Standards (Washington, D.C.), (August 1934).

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